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ABSTRACT

This curriculum guide is intended for use in an ungraded science program encompassing grades one, two and three in public elementary schools in southwestern North Dakota. Five major units in the biological, physical and earth sciences and in health education are included. In each unit major concepts to be studied are stated. For each concept, activities and "things to do" are enumerated. Lists of films, filmstrips and transparencies as well as reading materials related to each concept are provided for both teacher and students. Names and addresses of publishers and equipment suppliers are provided in the appendix. (BC)

ED051990

An Ungraded Primary Level Science Program

Levels one through three

(Grades 1-2-3)

JUNE, 1967

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Instructional Media Center
Dickinson Public Schools
Dickinson, North Dakota

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PREFACE

The Instructional Media Center, Dickinson, North Dakota, is completing its first year of operation. During that first year, a number of curriculum projects largely in cooperation with the Dickinson Public Schools have been undertaken. The results are being made available to the area schools of Southwestern North Dakota.

The Instructional Media Center makes available materials--commercially produced or locally designed and prepared. The prime emphasis of adequate materials, however, is based on curriculum content and solid needs arising thereof.

In each curriculum project described materials are needed that have not been readily available previous to existence of the Media Center. The less expensive materials would, of course, be provided at the local district level. These initial projects were made possible primarily through funding by the Dickinson Public School District using local, N.D.E.A., and an Arts and Humanities Grant, as well as the Instructional Media Center.

Each curriculum innovation is prepared in a separate brochure and is available from the Media Center for use in the area schools. Materials are identified in each project that may be available for Southwestern North Dakota schools for instructional use from the Instructional Media Center.

The projects now completed are as follows. Credit is given to the individual instructor and their employing institution who worked diligently in the initial preparation and instituting the project.

I. An Ungraded Primary Level Science Program--levels one through six (Grade 1-2-3)

Mr. Myron Freeman--Professor of Biology, Dickinson State College

Mr. John Anderson--Professor of Biology, Dickinson State College

II. La Familia Fernandez--a complete systems approach to the teaching of Spanish

Mrs. Sheryl Novacek--Dickinson High School Faculty

III. Deutsch Durch Audio-Visuelle Methode--an audio-lingual approach to the teaching of German

Mr. Eckhart J. Heid--Chairman, Dickinson High School Foreign Language Faculty

IV. An Instructional Unit in Mass Media for use in communication classes at the secondary level

Mrs. Agnes Oxton--Chairman English Department, Dickinson High School

Mr. Ed Sahlstrom, Instructor, Dickinson High School

V. A Study in the Use of Programmed Mathematics Material at the Ninth Grade Level

Mr. Larry Rafferty, Chairman, Mathematics Department, Dickinson High School

Mr. Robert Scott, Dickinson High School Faculty

Mr. James Peters, Dickinson High School Guidance Department (Evaluation Assistance)

The Instructional Media Center takes a special pride in having been able to have had the fine professional cooperation and help by these most able people.

General coordination of the projects has been under the direction of the curriculum coordinator of the Instructional Media Center, Mr. Vernon F. Hagen. Special consultive assistance and help has been provided by Mr. Kirian L. Dooley, and Mr. George Fors of the North Dakota Department of Public Instruction.

Special thanks is due the administrative leaders of the institutions who made their staff available, Dr. O. A. DeLong, President of Dickinson State College and Cecil B. Risser, Principal of Dickinson High School. Certainly any activities undertaken by the Instructional Media Center must also give credit to the educational leadership asserted by Donovan B. Benzie, Superintendent of Schools, Dickinson, North Dakota.

It is the sincere hope of the Instructional Media Center that these curriculum innovations and studies will be coordinated into the academic curriculum in Southwestern North Dakota.

The Instructional Media Center is thankful it can continue to supply many of the materials needed to implement these programs.

Gordon L. Paulsen, Director
Instructional Media Center
June 15, 1967

NORTH DAKOTA DEPARTMENT OF PUBLIC INSTRUCTION

George Fors, Science Consultant

At one time, curriculum guides in science could be written and used for many years. Today, curriculum guides need to be changed and revised often. It has been found that students in the elementary grades are very interested in science and can learn more about science than was formerly thought possible.

Traditionally the major agencies for curriculum determination in our schools have been (1) textbook publishers and (2) State Department of Education. Most recently, National Science Foundation funded national groups are assuming this function. However, more functional curriculum guides can be produced by the local school district or area school districts and this is their responsibility. This does not mean that the advice and wisdom of the traditional agencies should be neglected. Instructional materials should be chosen from all sources including the good ideas of the staff of these schools.

A continuous in-service program is necessary to keep a good program going and to continue its growth. Curriculum guides must be flexible, subject to change and use all available material and resources. As long as our society continues to change, the curriculum must change.

The Instructional Media Center at Dickinson has undertaken a project to write a science curriculum guide for grades one through six. The Department of Public Instruction is following this project with interest and encourages this type of activity. The general outline, visual aids, references, and activities look interesting for both pupil and teacher.

The personnel, interested in science curriculum, in the Department of Public Instruction will do whatever they can to help this curriculum planning. The questions, What Should We Teach?, When Should We Teach It?, and How Should We Teach It? are important at every grade level. There are no clear cut answers to these questions. Teachers must strive to find answers for each individual pupil, based on what he has already learned.

A Multi-Level Ungraded Primary Science Outline

INTRODUCTION

Definition

The guideline is designed to be used at three levels of instruction. It may be readily adapted to a graded program, but it was primarily designed for an ungraded multi-level science program for primary school age children.

Ungraded multi-level primary science program is defined to mean that the study will provide for a child of six, seven or eight years in level one, two or three. Each level is intended to be successively more involved than the preceding level. A child of seven may be in level three, he may be in level two, or one, depending on his rate of achievement.

Organization of the study is focused around thirty-one major concepts in five units of study. Each concept is overlapped in each successive level to provide a "spiral approach" for more inquiry into the subject matter.

The Instructional Media Center will develop other levels in another study to accommodate the older children at a later date.

If each concept is studied for one week, then thirty-one weeks will be used to teach the course. The teacher must use her own discretion as to the proper use of time.

Rationale

Jean Piaget, the famous Swiss child psychologist, discovered long ago that children learn in quite distinct stages. Children from ages seven to twelve enter the learning stage which Piaget refers to as the "concrete operations" stage. One may quarrel with the rigidity of age brackets because of individual differences of when he begins or ends the level of learning though it is relative.

"Concrete operations" means actual reasoning carried on with things that are not too far from reality, objects and real situations. Abstractions are a much higher level of reasoning.

If one accepts the hypothesis that any subject can be taught effectively in some intellectual honest form to any child at any stage of development than imaginative teaching must accompany every child.

Concept development, certainly an abstraction, then must be approached by successive concrete operations. It was the intent of this organization to approach the drafting of this study with concept formation through the development of "concrete operations," real objects, used through laboratory experiences, however, we are not satisfied in all cases that this is done adequately. Further refinement of experiences will be necessary. The guidelines are designed in this manner because the child learns most with active discovery experiences, even though teacher demonstrations may be quicker. Learning and thinking are of prime essence.

In leading the child to learn by discovery, the teacher has a vital role of acting as a catalyst of educational reaction.

Purpose

The Instructional Media Center has, as one of its objectives, the development of a model science program.

Extensive audio-visual materials are "cross-referenced" with each unit of the guideline. The audio-visual materials are available to participating schools through the Instructional Media Center. Fifteen different science series are "cross-referenced" to the units. Children's books and teacher references, too, are listed. The Center will provide the audio-visual materials; schools must provide the library and reference books.

By joining concrete teaching strategies with extensive audio-visual materials, fine reference books, curious imaginative youngsters and enthusiastic, inspiring teachers, learning and thinking ought to occur.

Vernon F. Hagen
Curriculum Coordinator

A VERTICAL PROGRAM IN SCIENCE

Grade				
12	Physics	Could Include or Become PSSC-Type Program		
11	Chemistry	Could Become Chem Study or CBA Types		
10	Biology	Could Become BSCS Type Program		
9	Physical Science	Lab. Procedures, Measurement, Machines, Sound, Light, Heat, Chem, Electricity		
8	Earth Science	Astronomy and Space	Meteorology	Geology
7	Life Science	Living Things, Agriculture, Conservation	Human Body	
6	Living Things	Sky Earth	Matter - Energy	
5	Living Things	Sky - Earth	Matter & Energy	
4	Living Things	Sky	Earth	Matter & Energy
3	Living Things	Above the Earth	Earth	Matter & Energy
2	Living Things	Above the Earth	Earth	Matter & Energy
1	Living Things	Above the Earth	Earth	Matter & Energy

Blocks of Time are Suggestive for Grades 1-8

--Harald N. Bliss, Science
Constltant

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x

CONCEPTS FOR EXPLORATION ARE AS FOLLOWS

Life Science

1. Differentiate and Compare Living and Non-Living Things
2. Plants
3. Non-Green Plants (Molds, Mushrooms, Puffballs, and Yeasts)
4. Plants--Where do Plants Come From: Seeds
5. Reproduction
6. Animals
7. Living Things in Their Environment

Earth Science

8. Earth's Shape and Surface
9. Changing of the Earth's Surface
10. Earth's Water
11. Soil
12. Minerals
13. Fossils

Matter and Energy

14. Different Materials of the World
15. Materials and Measurement
16. Forms of Matter
17. Fire
18. Air
19. Gravity
20. Magnetism or Magnetic Force

21. Heat and Light

22. Machines

23. Sound

Beyond the Earth

24. Universe

25. Sun

26. Stars in Space

27. Weather and Climate

28. Clouds and Rain

29. Storms

Health

30. How Living Things Grow

31. All Living Things Are A Product of Their Heredity and Environment

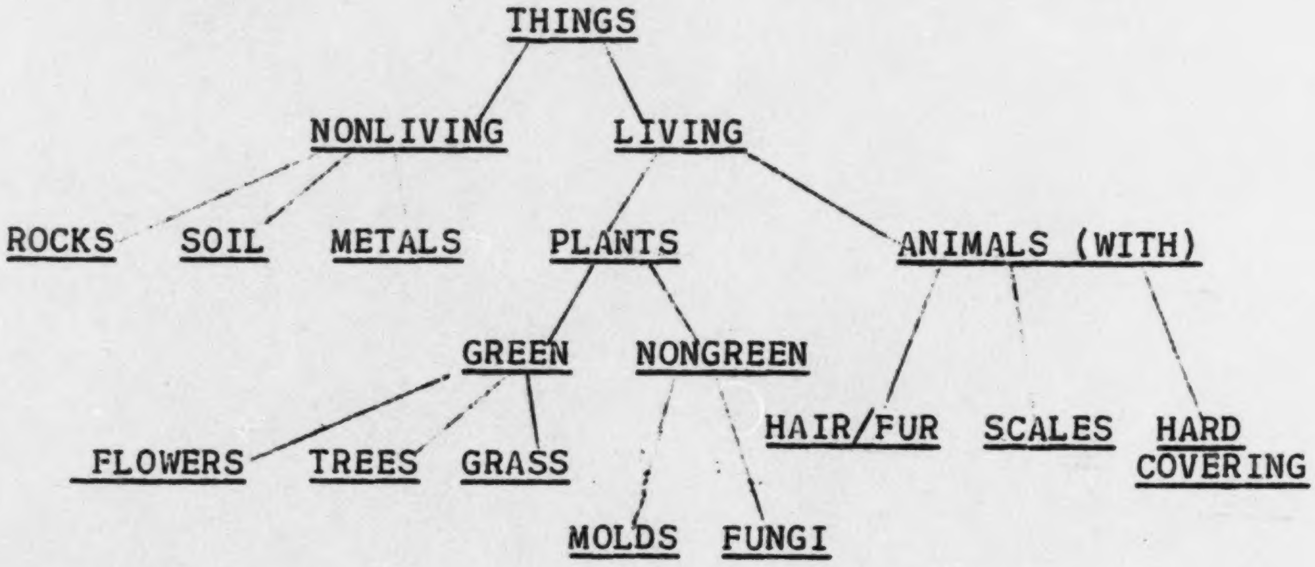
LIFE SCIENCE UNIT

CONCEPT # 1

Differentiate and Compare--Living and Non-Living Things

ACTIVITIES:

1. Discussion


THINGS
NONLIVING
LIVING
ROCKS
SOIL
METALS
PLANTS
ANIMALS (WITH)
GREEN
NONGREEN
HAIR/FUR
SCALES
HARD COVERING
FLOWERS
TREES
GRASS
MOLDS
FUNGI

THINGS TO DO:

1. How are non-living things and living things alike? How are they different? Have examples of both for study and differentiation.
2. Make drawings, observe items and indicate whether they are living or non-living? Explain why--(may leave an open question)
3. Cut out illustrations of living things from magazines, etc.

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Beauchamp, Challand, Basic Science Handbook, Levels K-3, Scott, Foresman and Company.

Eggleston, About Things That Grow, Children's Press, Level 2.

Children's Books Con't.

Meeks, Mammals, Follett Publishing Company, 1965.

Podendorf, I., Discovering Science on Your Own, Melmont, Levels 2-5.

Rood, Sea and Its Wonderful Creatures, Whitman, Levels 2-3.

Shannon, About Food and Where It Comes From, Childrens Press, Level 3.

Solem, Life Along The Sea Shore, Encyclopaedia Britannica Press, Levels 3-4.

Van Rochel, From Fins to Feathers, Harper, pp 12-72, Levels 2-3.

Films

Living Things Are Everywhere, EBF, IMC #73.

Living Things In A Drop Of Water, EBF, IMC #485.

Food From The Sun, EBF, IMC #1015.

Filmstrips

Discovering Life Around Us, EBF, IMC FS#286.

Plant Life, EBF, IMC FS#200.

Prehistoric Life, EBF, IMC FS#28, 29.

Textbooks (Level 1)

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Navarra, J., Today's Basic Science, pp 6-11, 66-103, Harper, 1967.

Textbooks Con't.

Schneider, H., Science for Work and Play, pp 9-13, 76-101, Heath, 1967.

Level 2

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Navarra, J., Today's Basic Science, pp 6-19, Harper, 1967.

Smith, H., Science 2, pp 8-16, 49-58, Laidlaw, 1966.

Tannenbaum, H., Experiences in Science, Unit 3, McGraw-Hill, 1966.

Level 3

Blough, G., Basic Science Series, Book 3, Unit 1 and 7, Scott, Foresman and Company, 1965.

Bond, H., Knowing About Science, pp 55-76, Lyon and Carnahan, 1963.

Brandwein, P., Concepts in Science, Unit 8, Harcourt, 1966.

Craig, G., Science, Everywhere, "Finding Out What Is Around Us" Unit 1, "Living Through Many Changes" Unit 4, "Plenty Times For Living Things" Unit 9, "Living Things Change the Land" Unit 10, Ginn and Company, 1965.

Jacobson, W., Learning In Science, "Living and Non-Living Things" pp 130-160, American Book, 1965.

Navarra, J., Today's Basic Science, "Experimenting In Science" pp 6-19, "Plant and Animal Communities" pp 54-79, "Life in the Big Pond" pp 192-223, Harper, 1967.

Schneider, H., Science Far and Near, "Life On The Desert" pp 21-34, "A Pond Community" pp 35-66, "The Big Ocean" pp 79-91, Heath, 1965.

Smith, H., Science 3, "Living Things And What They Need" pp 18-36, "Living Things And Where They Live, pp 37-49, "Living Things and How They Adapt" pp 50-66, Laidlaw, 1966.

Tannenbaum, H., Experiences In Science, Unit 5 and 6, McGraw-Hill, Webster Division, 1966.

Transparencies

3M Transparency Master Packets, IMC #116, 117, 118, 159.

Teacher's References

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Johnson, Gaylord, Hunting with the Microscope, Sentinel Books, Publishers Inc., 112 East 19th Street, New York 3, New York, 1956.

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CONCEPT # 2

Plants

ACTIVITIES:

1. Plant Parts
    a. Leaves
    b. Stem
    c. Root
    d. Flower
    e. Roothairs
2. Function of Parts
    a. Leaves produce food
    b. Roots obtain mineral and water
    c. Stems support and provide transportation
    d. Use by humans of various parts

THINGS TO DO:

a. Select plants for observation, demonstrations, and exploration. (Almost any leafy flowering plant will do--a variety of different species is desirable)

b. Use the magnifying glass to observe the various parts: 1) Cut the root in cross-sections, 2) Examine the underside of the leaf, the variation of the leaf--notice different types of veins in different varieties of plants. Are some of the veins of the leaf parallel? Are others like the fingers attached to your hand? Are others arranged like the veins of a feather?

c. Remove several stems and place them in water to produce roots for exploration in the next concept.

Films

What is a Plant, EBF, not yet released

A Tree is a Living Thing,, EBF, IMC #83

Plants Useful to Man, EBF, not yet released

Filmstrips

How Plants and Animals Live and Grow, EBF, IMC #237

What Plants Need for Growth, EBF, not yet released

Plants Useful to Man, EBF, not yet released

Learning About Plants, EBF, IMC #239

Tapes

Let's Find Out About Trees, IPI, IMC #T 59

Let's Find Out About Plants, IPI, IMC #T 47

Textbooks

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Blough, G., Basic Science Series Book 1, "How Can We Tell One Plant From Another", Unit 4, Scott, Foresman and Company, 1965.

Bond, H., Looking at Science, pp 43-51, Lyon and Carnahan, 1963.

Brandwein, P., Concepts in Science, "Plants and More Plants" Unit 7, Harcourt, 1966.

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Schneider, H., Science for Work and Play, "Seeds and Plants" pp 102-116, Heath, 1965.

Level 1 Con't.

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Tannenbaum, H., Experiences In Science, "Plants in the Spring" Unit 6, McGraw-Hill, Webster Division, 1966.

Level 2

Bond, H., Thinking About Science, "Trees" pp 26-51, "Seeds" pp 143-163, Lyon and Carnahan, 1963.

Brandwein, P., Concepts in Science, "Plants Live and Grow" Unit 6, "We Grow and Change" Unit 8, "Millions of Years Ago and Now" Unit 10, "On Your Own--The Earth's Plants" Unit 11, Harcourt, 1966.

Jacobson, W., Searching in Science, "Plants" pp 34-64, American Book, 1965.

Navarra, J., Today's Basic Science, "Plants and How They Grow" pp 44-69, Harper, 1967.

Schneider, H., Science for Here and Now, pp 26-92, 93, 94, 180-186, 189, Heath, 1965.

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Bond, H., Knowing About Science, "Plants" pp 44-55, Lyon and Carnahan, 1963.

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Fischler, A., Science, A Modern Approach, "Plants" Unit 1, Holt, 1966.

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Earth Science Curriculum Project, Investigating the Earth, Houghton Mifflin Company, 1967.

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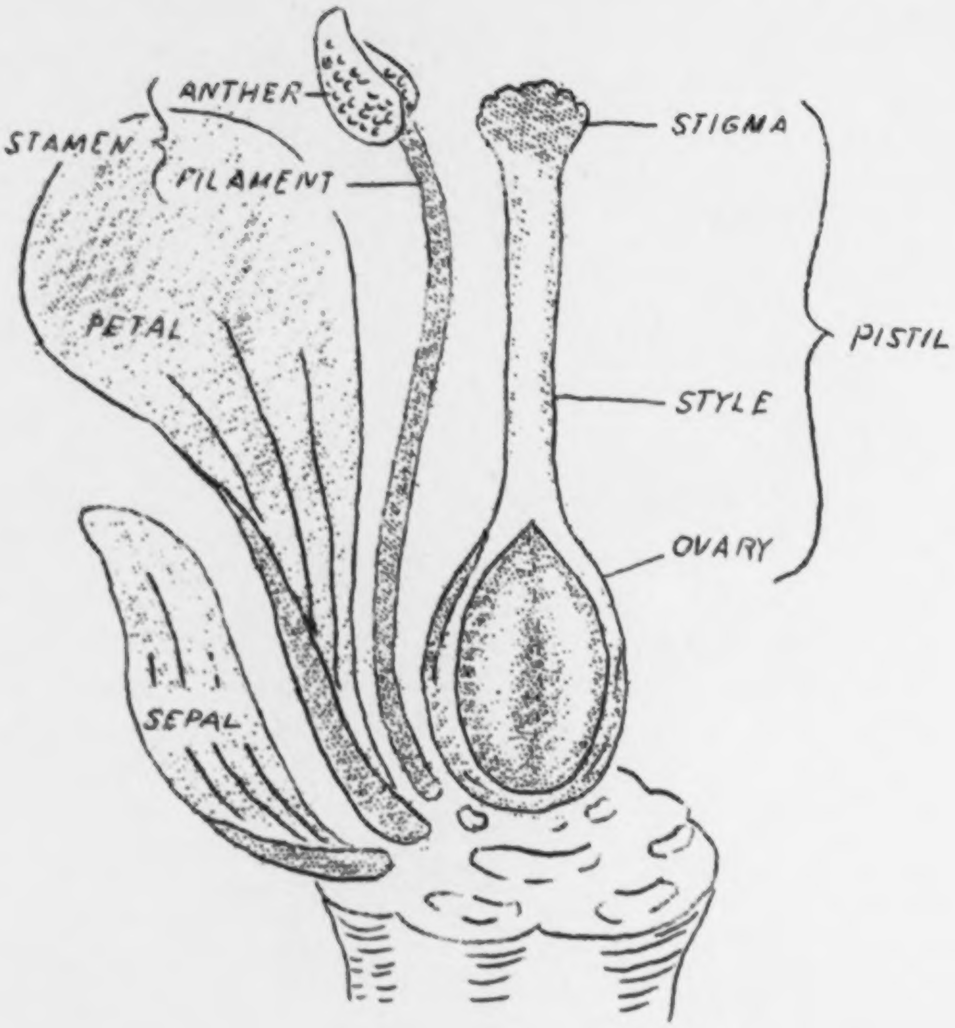
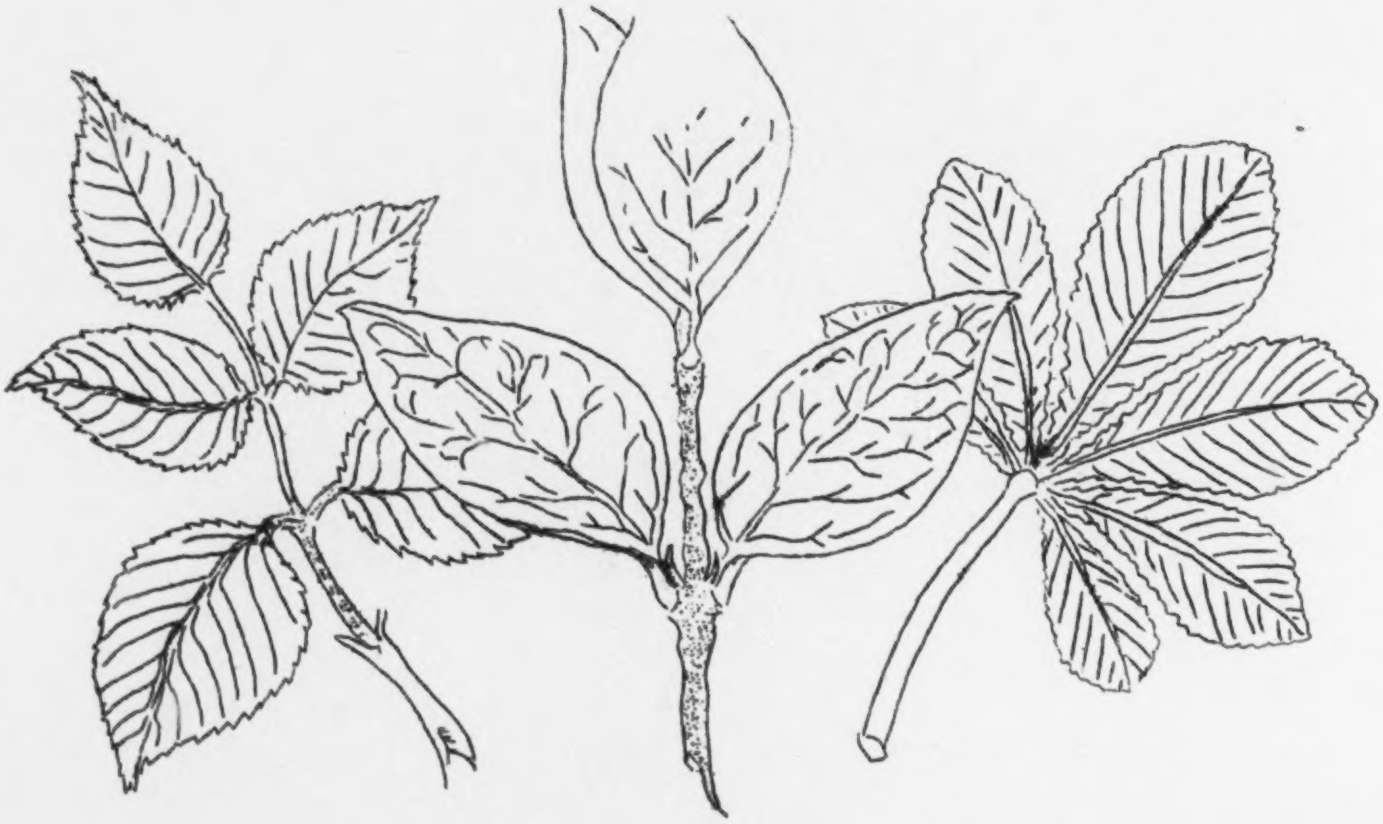
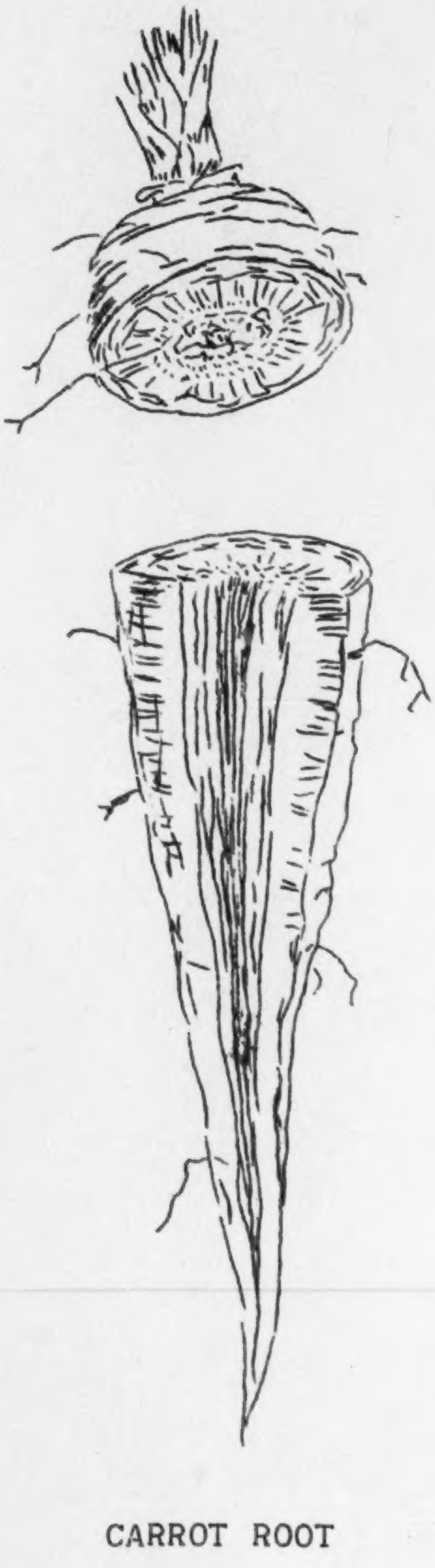

ANTHER
STAMEN
FILAMENT
PETAL
SEPAL
STIGMA
PISTIL
STYLE
OVARY

DIAGRAM OF A FLOWER



LEAF, EXTERNAL FEATURES



CARROT ROOT

CONCEPT # 3

Non-Green Plants (Molds, Mushrooms, Puffballs, and Yeasts)

ACTIVITIES:

1. Students may bring all types of spoiled or spoiling food from home. (Bring them in a plastic bag)
2. OBSERVE: Types of Non-green plants
   - a. Color
   - b. Shapes
   - c. Texture
   - d. Smell

   (Note each type is different)
3. Investigate:

   Each type of mold must grow from some source of food--cannot make its own.

THINGS TO DO:

1. Bring in a slice of bread, wipe it on the floor. Place it in a moistened plastic bag and watch the fungi grow. (Keep it in the dark, desk drawer)
2. Place a small amount of yeast in a glass of warm water with some sugar and watch it grow as it bubbles (using the sugar as a food--bubbles show the release of carbon dioxide just as we do when we breathe.)
3. Magnifying glasses would be most useful for observation.

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Brandwein, P., Concepts in Science 3, pp 212, 243, Harcourt.

Children's Books Con't.

Frahm, Anne, True Book of Bacteria, Childrens Press, 1963.

Kohn, Our Tiny Servants, Molds and Yeast, Prentice-Hall.

Films

Our Tiny Servants, Molds and Yeast, Prentice-Hall.

Story of Mosses, Ferns and Mushrooms, Doubleday, Garden City, New York.

Filmstrips

Mushrooms, SVE (not at the IMC)

Plant Life, EBF, IMC #200

Fungi, Our Non-Green Plants, McGraw-Hill (not at the IMC)

Dependent Plants, SVE (not at the IMC)

Textbooks

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Smith, H., Science 1, pp 29-34, Laidlaw, 1966.

Level 2

Brandwein, P., Concepts in Science, pp 175-184, Harcourt, 1966.

Jacobson, W., Searching in Science, pp 35, American Book, 1965.

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Strong, C. L., *The Amateur Scientist*, The Scientific American Book of Projects, Simon and Schuster, New York, 1960.

Turtox Service Leaflet No. 25, General Biological Supply House, 8200 South Hayne Avenue, Chicago, Illinois, 60620.

CONCEPT # 4

Plants--Where do Plants Come From: Seeds

ACTIVITIES:

1. Obtain lima bean seeds - one for each student (may use other bean seeds also)

2. (Suggestion for teacher: soak seeds overnight)
   a. How does this differ from and compare to eggs?

3. Show varieties of seeds--corn, beans, grains, trees, vegetables, etc.

4. Note specifically each seed is different--in different plants.

5. Cut open the lima bean seeds to see the little plant inside with its stem, root, and leaves. (plant in a jar insert blotter around the outside; fill sand or dirt in center, place seeds between glass and blotter.)

6. Use leftover seeds and place in a glass with paper toweling to show how seeds grow.

   Cut a piece of paper toweling to fit from top to to bottom in the glass around the inside of the glass. Place seeds between the towel and the glass (so growth of seeds can be observed). Place small amount of water in glass to be sure paper is well soaked and remains so, fill the center of the container with inert material.

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Filmstrips

How Seeds Sprout and Grow Into Plants, EBF, IMC #239

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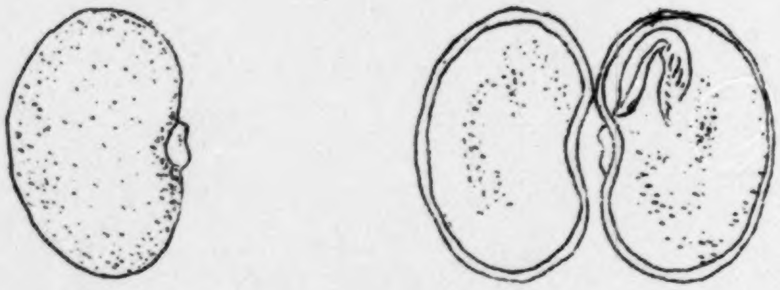
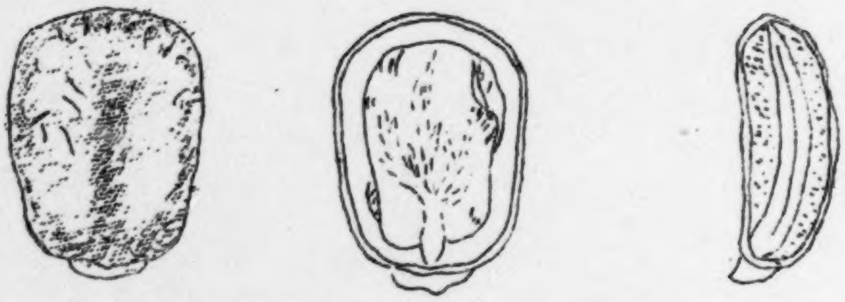


LIMA BEAN SEED



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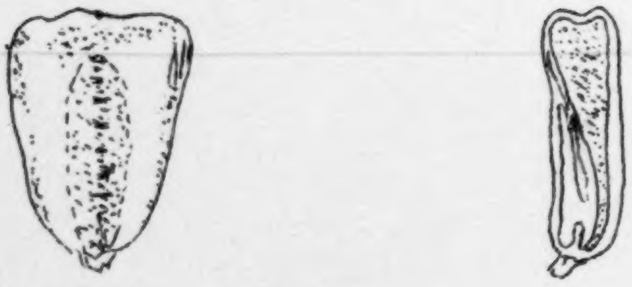
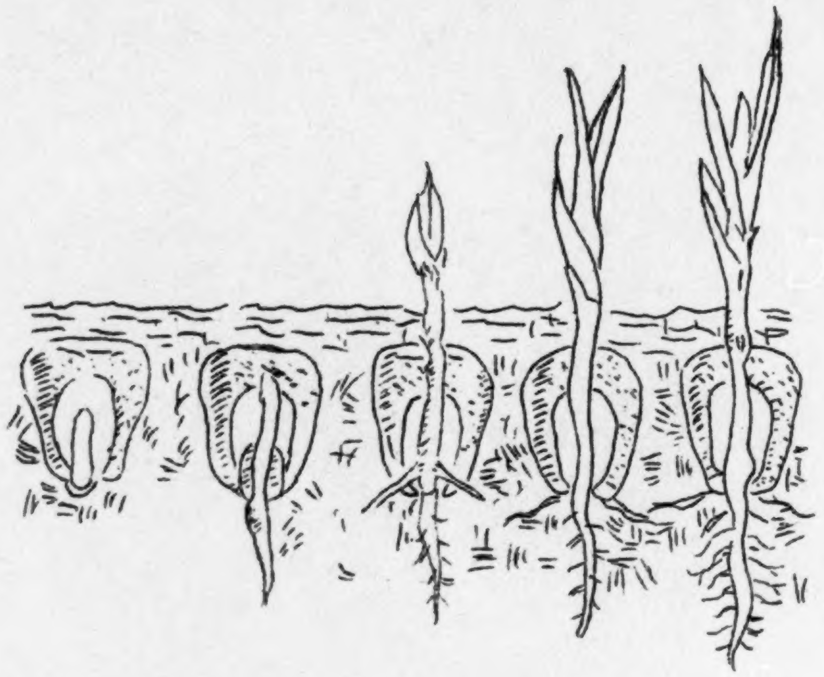
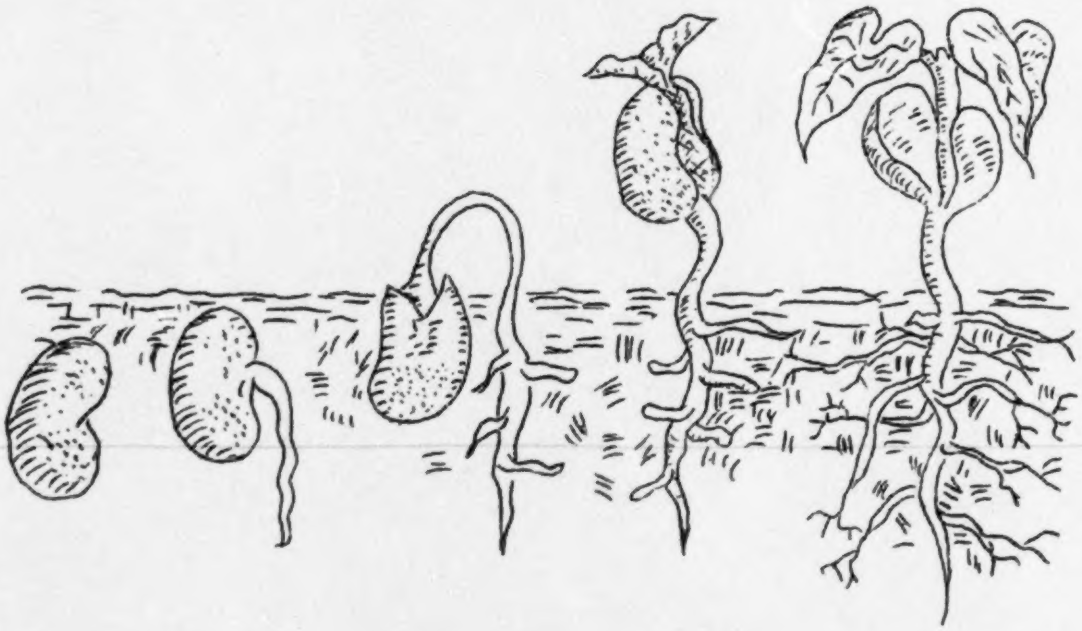


CORN GRAIN



CORN SEED GERMINATION



BEAN SEED GERMINATION

CONCEPT # 5

Reproduction

ACTIVITIES:

1. Plants - Make differentiation of seeds and of fruits
2. Note types of fruits and the seeds they contain--citrus fruits, apple, plums, grapes, etc. (grains, corn, garden seeds, and fruits)
3. Place a carrot and sweet potato in water.

   Shoots--show growth different type of growth
4. Observe growth of the plant from the seed
5. Where else do plants come from other than seeds?

THINGS TO DO:

1. Slips
2. Cuttings

   Coleus, geranium, or willow

   (take a part of the stems of any of the above, remove all leaves except one or two at the top, place in glass of water until roots develop.

REFERENCES:

Films

Seed Dispersal, EBF, IMC #235

Filmstrips

Finding Out About Seeds, Bulbs, and Slips, SVE (not at IMC)

Learning About Plants, EBF, IMC #239

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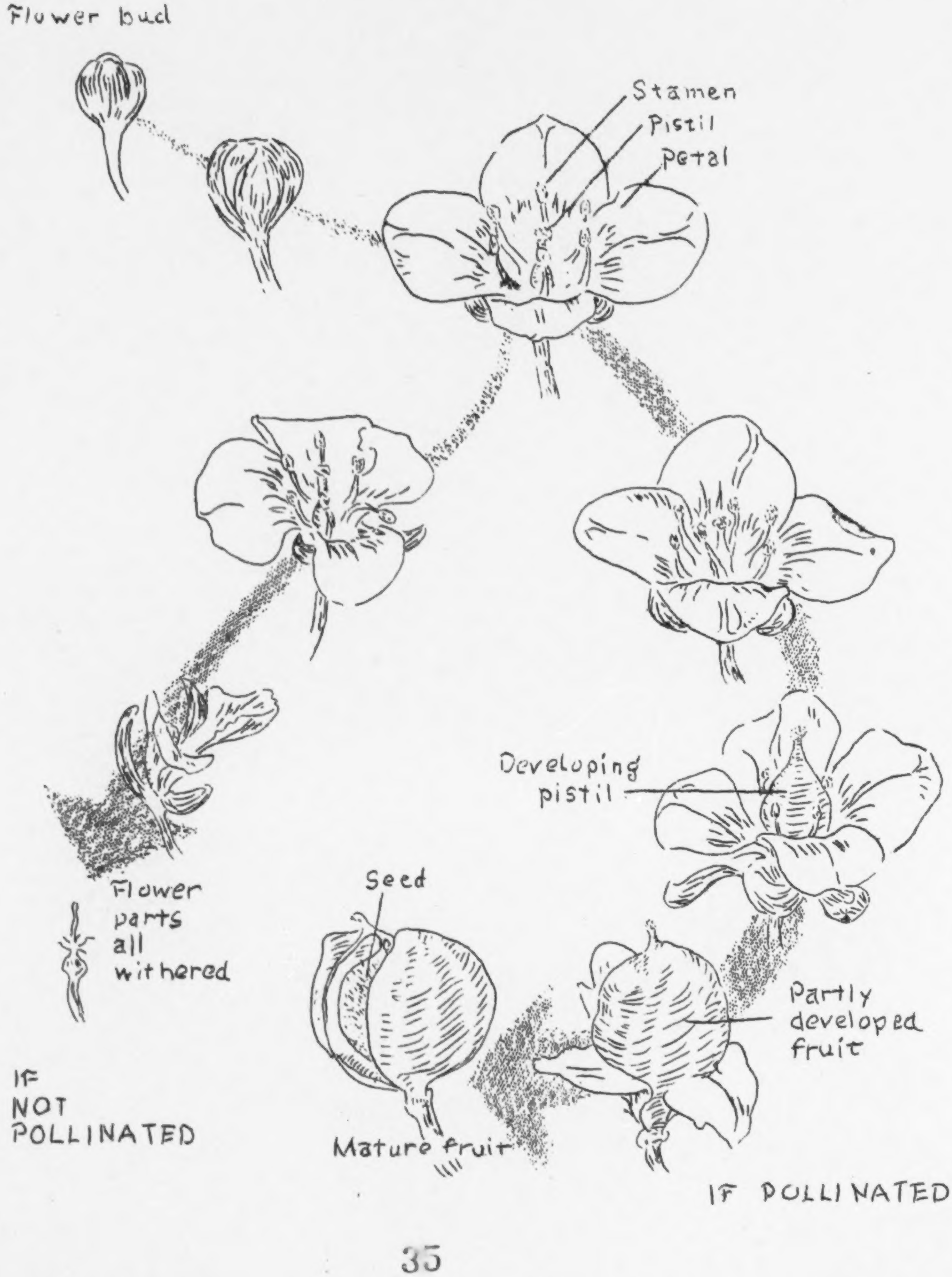
REPRODUCTION IN FLOWERING PLANTS


Flower bud
Stamen
Pistil
petal
Developing pistil
Flower parts all withered
Seed
Partly developed fruit
Mature fruit
IF NOT POLLINATED
IF POLLINATED

CONCEPT # 6

Animals

ACTIVITIES:

1. Introduction into the classes of animals, higher and lower (with and without backbones)
2. Illustrate
    a. Fishes
    b. Amphibians
    c. Reptiles
    d. Birds
    e. Mammals
3. Lower animals without backbones--insects, clams, snails, earthworms, spiders, lobsters, etc.
4. Learn about each of these groups by means of pictures, drawings, coloring, cutouts, etc.
5. Animal reproduction, growth and development
    a. Born alive as in mammals or from eggs as in birds, reptiles, insects and amphibians

THINGS TO DO:

1. Pair of gerbils, frog eggs, insect eggs, bird eggs, etc. (domestic pets can be used)
2. "Like begets like", See Paul de Kruif's Microbe Hunters, "Spallanzani" Microbes must have Parents, pp 22-52, Pocket Books, Inc., New York, 1961. Also see Brandwein's Concepts in Science, Teachers edition, Harcourt, Brace and Company, pp T4-T5, 1966.
3. Each day of the next two weeks, take up one of the groups listed in No. 2. Use film and filmstrip describing each group.

- a. Fishes
  - (1) Film: Looking at Fishes, EBF, IMC #76
  - (2) Filmstrip: Some Water Animals, EBF, IMC #238
- b. Amphibians
  - (1) Film: Looking at Amphibians, EBF, IMC #77
  - (2) Filmstrip: Learning about Amphibians, EBF, IMC #238
- c. Reptiles
  - (1) Film: Looking at Reptiles, EBF, IMC #78
  - (2) Filmstrip: Learning about Reptiles, EBF, IMC #238
- d. Birds
  - (1) Film: Looking at Birds, EBF, IMC #79
  - (2) Filmstrip: Learning about Birds, EBF, IMC #238
- e. Mammals
  - (1) Film: Mammals are Interesting, EBF, IMC #212
  - (2) Filmstrip: Learning about Mammals, EBF, IMC #238
- f. Small Animals
  - (1) Film: Looking at Small Animals, EBF, not yet released.

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Ukl, About Some Animals That Work For Men, Melmont, Levels 3-6.

Wasson, Birds, Follett, Levels 1-3, 1963.

Wood, Beavers, Follett, Levels 1-3, 1961.

Wormser, About Silk and Silkworms, Melmont, Level 3.

Films

Different Kinds of Animals, EBF, IMC #1007

Animals--Ways They Move, EBF, IMC #195

Animals--Growing Up, EBF, IMC #190

Filmstrips

Different Kinds of Animals, EBF, IMC #238

Insects--How They Live and Grow, EBF, IMC #225

Tapes

Let's Find Out About Baby Animals, IPI, IMC #T 43

Let's Find Out About Our Neighbors on the Farm, IPI, IMC #T 52

Textbooks

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CONCEPT # 7

Living Things In Their Environment

ACTIVITIES:

1. Animals that live in various places (discussion)
    - a. Tundra (frozen North)
    - b. Forest
        - (1) Coniferous
        - (2) Deciduious
    - c. Prairies
    - d. Desert
2. How are the animals different from animals of another place? How are they alike? Can you compare vegetation and contrast it too? Why is there this difference?
3. Are the living things similar on the north side of the hill as they are on the south side? If you note differences, why do you think there are differences? You might find what kinds of plants on the north side? on the south side? on which side are the most of the animal burrows dug? Look into the ravines. Are living things the same in the bottom as on top of the knoll?
4. Why would you not find a snake in the frozen north?

THINGS TO DO:

1. Take a field trip to find evidence of question 3, to verify or deny the supposition. Inquiry is of essence. Not all problems will have answers.

    The children might list all of the living things they saw at each area. They might be asked, "Where did you find each variety? The teacher might stop at a locality, and observe with the children what living things seem to be in the valley, what living things are on the hill top, and what living things thrive on in between. She might then look at the other side of the hill and see if there is a difference in living things at a variety of levels.

After having observed where everything is, the teacher might ask, "Why do you suppose the (name of animal or plant) lives at such a location on the hill?" She could go through the list of plants and animals if time permits.

The children might look into the air for insects and birds, into a stream or creek or lake for living things. Field trips offer an unlimited opportunity to see "life in action."

An imaginative teacher will become just as excited as the children over her discoveries in the field.

2. Observe rabbits and weasels as they change colors in winter. Why do you think this happens? What are some of the reasons why you think it happens? You might not be able to answer such questions. The teacher should not provide answers for all of life. Leave the questions as open, unanswered questions when no known answers can be given.

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Insects in a Garden, EBF, IMC #80

Life in a Vacant Lot, EBF, IMC #565

How Nature Protects Animals, EBF, IMC #208

Animals Growing Up, EBF, IMC #190

Animals in Autumn, EBF, IMC #189

Animals In Summer, EBF, IMC #192

Animals in Spring, EBF, IMC #191

Animals in Winter, EBF, IMC #196

A Badger's Bad Day, Grover-Jennings, IMC #642

Beaves, EBF, IMC #198

Big Land Animals of North America, EBF, IMC #199

Bird Homes, EBF, IMC #200

Desert Community, EBF, IMC #483

Discovering the Forest, EBF, IMC #1082

Forest Babies, Grover-Jennings, IMC #641

Filmstrips

Plant and Animal Relationships, EBF, IMC FS#276

The Living Desert, EBF, IMC FS#84

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Blough, G., Science is Fun, "Animals Can Move." Unit 3, "Animals Need Other Living Things" Scott, Foresman and Company, 1965.

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Bond, H., Thinking about Science, pp 56-70, 76-77, 157-160, Lyon and Carnahan, 1963.

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EARTH UNIT

CONCEPT # 1

Earth's Shape and Surface

ACTIVITIES:

1. Appearance of the earth.
    a. At ground level it appears rounded
    b. From an airplane it appears flat (Soil Conservation Office may lend the class aerial photos)
    c. In a space vehicle it appears rounded (use encyclopaedia)
2. Check the earth's shape by comparing what one knows of it to a globe.
3. Note the vastness of the earth. How deep are the oceans? How high are the mountains?
4. Parts of the earth's surface, compare areas of land and water. Where is the air? How thick is the air? Why is the air where it is? Why do airplanes that fly above 9000 feet provide oxygen mixture in the planes for the passengers and crew?
    a. Land
    b. Water
    c. Air
5. Use a globe or map and point out the above features.
6. Take a field trip, observe land, water, and air.

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Preston, E., Air, Follett, 1965.

Schwartz, J., I Know A Magic House, McGraw-Hill, Webster Division.

Ziner, T., Weather Experiments, Childrens Press, 1961.

Films

(For Activity #1, 2, 3)

How Do We Know The Earth's Shape, FA, B/W, 11 minutes

The Earth In Motion, EBF, IMC #66 (Level 3)

Exploring the Universe, EBF, IMC #68 (Level 3)

Yours Is The Universe, EBF, IMC #324 (Level 3)

(For Activity #4, 5, 6)

Birth of the Soil, EBF, IMC #322 (Level 3)

Wind and What It Does, EBF, IMC #426 (Primary)

Filmstrips

The Four Seasons, EBF, IMC #262

Tapes

Let's Find Out About the Land Around Us, IPI, IMC #T 45

Let's Find Out About Air, IPI, IMC #T 44

Let's Find Out About the Four Seasons, IPI, IMC #T 48

Let's Find Out About the Earth's Crust, IPI, IMC #T 57

Let's Find Out About the Ocean, IPI, IMC #T 58

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Transparencies

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* Good teacher reference

CONCEPT # 2

Changing of the Earth's Surface

ACTIVITIES:

1. Discuss, flood and heavy rainfall and how water changes the earth's surface.
2. Visit a playground after a heavy rain and observe the gullies and places where the soil has been washed away. (A fallow field is good too.)
3. Introduce the term erosion.
4. Introduce the term conservation in relationship to soil
5. Discuss common soil conservation practices--observe if possible.
6. Contact your local Soil Conservation Service or County Agent for more information and possible lectures, talks, movies, etc.

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Textbooks Con't.

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Transparencies

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* Good teacher reference

CONCEPT # 3

Earth's Water

ACTIVITIES:

1. Water is necessary for life.
    a. Show, and discuss this need.
        (1) Demonstrate with two plants--one dry and one watered.
2. Most substances will dissolve in water.
    a. Try several substances such as sugar, salt, sand, jello, etc.
3. Some things float in water
    a. Experiment with a pan of water and several objects. Why does it float?
    b. Make boat travel if possible
    c. Try wood, iron and other materials, some hollow some solid
4. Water finds its own level
    a. Make a siphon (rubber tubing) between two pans. Why does water seek its own level?
5. Demonstrate water table (optional)
    a. Place sand in a jar, fill with water. The upper level of the water in the jar is the water table.
6. Demonstrate uses of water
    a. Power
    b. Drink
    c. Wash, etc.

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Lane, Ferdinand, All About the Sea, New York, Random House, 1953.

Pine, T., Water All Around, McGraw-Hill, Webster Division, 1965.

Films

Water and What It Does, EBF, IMC #424

Tapes

Let's Find Out About Water, IPI, IMC #T 41

Textbooks

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Craig, G., Science and You, "Water Around You," Unit 10, Ginn and Company, 1965.

Schneider, H., Science For Work and Play, pp 56-62, Heath, 1965.

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Bond, H., Thinking about Science, pp 98-121, Lyon and Carnahan, 1963.

Fischler, A., Science, A Modern Approach, Unit 2, Holt, 1966.

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Van Straten, Flo., Weather or Not, Dodd Mead and Company, New York, $5, 1966.

CONCEPT # 4

Soil

ACTIVITIES:

1. Soil is part of the earth's surface where organisms live. What are organisms?
2. Kinds of soils
    a. Clay
    b. Sand
    c. Gravel
    d. Rocks
    e. Loam
3. What kinds of soils are good for growing plants and what is considered poor soil.
    a. Try growing plants in the different types of soils
        (1) Note results
4. Are some soils better for growing animals as well as plants?
    a. Observe soils around your area. If possible take a field trip.
5. Invite soil experts from the Dickinson Experiment Station (Tom Conlon, Dickinson, North Dakota) to meet with the class.

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Norling, J., Pogos Farm Adventure, A Story of Soil, Holt.

Page, L., Rocks and Minerals, Follett.

Podendorf, I., Rocks and Minerals, Childrens Press, Level 2-4.

Films

Birth of the Soil, EBF, IMC #322

Erosion Leveling the Land, EBF, IMC #59

Evidence From the Ice Age, EBF, IMC #60

Textbooks

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Craig, G., Science and You, "Our Soil" Unit 14, Ginn, 1965.

Jacobson, W., Looking at Science, pp 26-48, American Book, 1965.

Smith, H., Science 1, pp 38-51, Laidlaw, 1966.

Tannenbaum, H., Experiences in Science, Unit 4, McGraw-Hill, 1966.

Level 2

Jacobson, W., Searching in Science, pp 66-92, American Book, 1965.

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Bond, H., Knowing about Science, pp 162-167, Lyon and Carnahan, 1963.

Brandwein, P., Concepts in Science, pp 159-181, Harcourt, 1966.

Fischler, A., Science, A Modern Approach, Unit 2, Holt, 1966.

Schneider, H., Science Far and Near, pp 210-246, Heath, 1965.

Smith, H., Science 3, pp 71-89, Laidlaw, 1966.

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* Good teacher reference

CONCEPT # 5

Minerals

ACTIVITIES:

1. Observe many different types of rocks, these are examples of minerals.
2. Some rock minerals are valuable such as gold, silver, copper, iron, etc.
    a. Try to find some of the above minerals, are these different or the same as the one observed in Activity #1?
    b. Are any of these observed in our area?
3. Some minerals are valuable for other reasons such as minerals used by plants and animals
    a. Common table salt, calcium, phosphates, etc.
4. Rocks and minerals break down to form soil
    a. Weather action breaks down these rocks and minerals as water, ice, frost, heat, etc. does

REFERENCES:

Children's Books

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Films

Evidence From the Ice Age, EBF, IMC #60 (Level 3)

Textbooks

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Level 3

Brandwein, P., Concepts in Science, pp 159-163, Harcourt, 1966.

Schneider, H., Science Far and Near, pp 266-279, Heath, 1965.

Transparencies

3M Transparency Packets, IMC #116, 118, 165, 166, 168

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* Stone, George K., Science You Can Use, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, pp 298-332, 1964.

* Strong, C. L., The Amateur Scientist, The Scientific American Book of Projects, Simon and Schuster, New York, pp 217-227, 1960.

* Good teacher reference

CONCEPT # 6

Fossils

ACTIVITIES:

1. A fossil is any evidence of prehistoric life
2. Most common fossils are animals
3. Most common fossils in our area are plants
    a. Leaves and wood
        (1) Leaves, found southwest of Dickinson about ten miles
        (2) Wood, found along stream banks
4. Fossil fish and mammals may also be found
5. Have students bring in any fossils they have found
6. These fossils are a record of animals and plants that lived before. Was this long ago? Why did they die? Why were they preserved?

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Clark, M., Dinosaurs, Childrens Press, Levels 1-4.

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Films

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Filmstrips

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Textbooks

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Level 2

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Level 3

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* Stone, George K., Science You Can Use, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, pp 310-313, 317, 1964.

* Strong, C. L., The Amateur Scientist, The Scientific American Book of Projects, Simon and Schuster, New York, pp 471, 1960.

* Turtox Service Leaflet, leaflet #46, General Geological Supply House.

* Good teacher reference

MATTER AND ENERGY UNIT

CONCEPT # 1

Different Materials of the World

ACTIVITIES:

1. List on board the different kinds of materials you observe.

   a) in the classroom, b) in the school yard

2. Group them by charting according to:

   a. Size

   b. Shape

      (1) Shape or

      (2) Shapelessness

         What shape can you observe?

   c. Weight

   d. Texture

   e. Color

   f. Odor

3. Note similarities and differences of the materials from the above chart

   a. Note ones that have similar shape, size, color, etc.

4. An addition to the list can be made from things that have been brought from home. (homework) No attempt at these levels of study need be made to define matter and energy.

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Children's Books

Freeman, M., The Story of Chemistry, Random House

Hyde, M., Atom's Today and Tomorrow, McGraw-Hill

Pine, T., Friction All Around, McGraw-Hill

Podendorf, I., The True Book of Energy, Childrens Press

Victor, Molecules and Atoms, Follett

Films

Ways To Find Out, Churchill, IMC #787

Electricity and How It Is Made, EBF, IMC #246

Light and What It Does, EBF, IMC #258

Tapes

Let's Find Out About Electricity, IPI, IMC #T 60

Let's Find Out What Makes Things Move, IPI, IMC #T 51

Textbooks

Bond, H., Looking at Science, pp 24-41, Lyon and Carnahan, 1963.

Jacobson, W., Looking at Science, pp 122-141, American Book, 1965.

Level 2

Brandwein, P., Concepts in Science, pp 2-14, 26-38, Harcourt, 1966.

Jacobson, W., Searching in Science, pp 98-106, American Book, 1965.

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Level 3

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* Strong, C. L., The Amateur Scientist, The Scientific American Book of Projects, Simon and Schuster, New York, pp 283, 333, 337, 1960.

CONCEPT # 2

Materials and Measurement

ACTIVITIES:

1. From previous work on size--make the students aware that size can be determined in various units of measurement such as inches, feet, and meters.
2. Introduce the idea of volume in relation to size and shape.
   a. Demonstrate by use of a glass with water in it--you may compare to volumes of other objects.
   b. Compare volumes of different shaped objects
3. From previous work with weight--demonstrate the idea of weight by:
   a. Using a ruler balance one object against another.
   b. Dry out an object. (apple or potato on a radiator by letting it set for a period of time to show that weight is lost)
   c. Show that weight can be increased by the use of a sponge in water (can use the idea of units of weight here also)

REFERENCES:

Children's Books

Carona, Philip, True Book of Numbers, Children's Press.

Textbooks

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Fischler, A., Science, A Modern Approach, Unit 6, Holt, 1966.

Tannenbaum, H., Experiences in Science, Unit 1, McGraw-Hill, Webster Division, 1966.

Textbooks Con't.

Level 2

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Smith, H., Science 2, pp 134-139, Laidlaw, 1966.

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CONCEPT # 3

Forms of Matter

ACTIVITIES:

1. Observe matter (materials) have weight and take up space. These materials have three forms.

2. Examples of each form:

   Solids - metals, wood, rubber, glass, etc.

   Liquids - ink, paint, milk, pop, etc.

   Gas - air

THINGS TO DO:

1. Freeze water in a pan. Let water in the pan melt, observe the solid and liquid forms, heat liquid to boil, steam in the gas form. Try to weigh the contents of various form.

2. Demonstrate liquids and gases and how they take up space (use of a balloon or plastic sack)

3. Show how liquids flow

4. Smoking candle shows gas

5. Use of perfume shows a gas, one cannot see but one can smell.

REFERENCES:

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Pine, T., Water All Around, McGraw-Hill

Victor, Molecules and Atoms, Follett

Films

Thermometers and How They Work, EBF, IMC #445

Air and What It Does, EBF, IMC #244

Tapes

Let's Find Out About Water, IPI, IMC #T 41

Textbooks

Level 1

Bond, H., Looking at Science, pp 53-59, Lyon and Carnahan, 1963.

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CONCEPT # 4

Fire

ACTIVITIES:

1. Demonstrate a fire, what is it?
2. Requirements of a fire (fuel and air in the form of oxygen) Show by demonstration.
3. How fires may be started
    a. Matches
    b. Lens to concentrate the sun's rays
    c. Friction, rubbing sticks together
4. What is flame?
    a. Parts of a flame
    b. Changes that take place as it burns
    c. Compare to charcoal when it burns without a flame
5. Fire prevention, demonstrate
    a. Fire extinguishers by removal of air, or lowering kindling temperature, or removal of fuel, or smothering the flame, etc.

REFERENCES:

Film

Fire and What Makes It Burn, EBF, IMC #250

Heat and How We Use It, EBF, IMC #253

Textbooks

Level 1

Jacobson, W., Looking at Science, pp 74-89, American Book, 1965.

Textbooks Con't.

Schneider, H., Science for Work and Play, pp 36-39, Heath, 1965.

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Schneider, H., Science Far and Near, pp 144-147, Heath, 1965.

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Strong, C. L., The Amateur Scientist, The Scientific American Book of Projects, Simon and Schuster, New York, 1960.

CONCEPT # 5

Air

ACTIVITIES:

1. How do we know air is real?

   a. Balloon

   b. Glass upside down in water (in a testtube or bottle)

   c. Medicine dropper

   d. Blow against a piece of paper, watch the wind blow waves on water.

2. Does air have weight or force?

   a. Fill glass with water, cover with 3 x 5 card and invert. Note water does not run out; force of air holds card on the glass. (use stiff paper card)

   b. Discuss force of wind as in storms, etc. Make a wooden propeller

   c. Have student obtain articles from the newspaper concerning force of wind.

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Pine, T., Air All Around, McGraw-Hill.

Films

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Wind and What It Does, EBF, IMC #426

Filmstrips

Primary Science, EBF, IMC #86

Tapes

Let's Find Out About Air, IPI, IMC #T 44

Textbooks

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Navarra, J., Today's Basic Science, pp 23-41, Harper, 1967.

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Strong, C. L., The Amateur Scientist, The Scientific American Book of Projects, Simon and Schuster, New York, pp 137, 417-420, 435, 436, 1960.

* Good teacher reference

CONCEPT # 6

Gravity

ACTIVITIES:

1. "The universal force" demonstrated by the weight of any object. Drop the article--use a spring scale.
2. Note all things fall except those objects lighter than the force of gravity. Try many objects as demonstrations.
3. Construct a simple balance

   (See pages 112-113, Elementary Science Handbook)
4. All moving objects are caused by gravitational pull.
   a. Water runs down hill, why?
   b. Roll ball down hill, etc.
5. What makes a ball stop going up when bounced?
   a. The force of gravity becomes greater than the force pushing it up.
6. Feel gravity
   a. Hold textbook in hand with the arm extended, note it gets heavier. Extend the arm, a short distance, extend it completely.

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Films

Gravity and How It Effects Us, EBF, IMC #252

Textbooks

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Craig, G., Science and You, Unit 7, Ginn and Company, 1965.

Level 2

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* Good teacher reference

CONCEPT # 7

Magnetism or Magnetic Force

ACTIVITIES:

1. Magnetic force may be used to overcome the force of gravity
    a. A bar magnet has enough force to lift a string of paper clips
2. What objects are attracted to magnets
    a. Try many objects and determine which will or will not be attracted
3. Magnetic force will penetrate objects
    a. Use piece of paper or glass, note magnet still has force to attract objects through the material. Which materials inhibit magnetic force? Which do not?

REFERENCES:

Children's Books

Podendorf, I., Magnets and Electricity, Childrens Press, Levels 2-5, 1961.

Pine, T., Magnets and How To Use Them, McGraw-Hill.

Films

Michael Discovers the Magnet, EBF, IMC #262

Filmstrip

Magnets, EBF, IMC #311

Tapes

Let's Find Out About Magnets, IPI, IMC #T 42

Textbooks

Bond, H., Looking at Science. pp 25-31, Lyon, 1963.

Craig, G., Science and You, Unit 15, Ginn and Company, 1965.

Textbooks

Navarra, J., Today's Basic Science, pp 118-129, Harper, 1967.

Schneider, H., Science for Work and Play, pp 46-55, Heath, 1965.

Level 2

Bond, H., Thinking about Science, pp 122-129, Lyon and Carnahan, 1963.

Jacobson, W., Searching in Science, pp 118-127, American Book, 1965.

Schneider, H., Science for Here and Now, pp 149-163, Heath, 1965.

Smith, H., Science 2, pp 154-156, Laidlaw, 1966.

Tannenbaum, H., Experiences in Science, Unit 1, McGraw-Hill, Webster Division, 1966.

Level 3

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* Loebsack, Theo, Our Atmosphere, The New American Library of World Literature, Inc., 501 Madison Avenue, New York 22, New York, Paperback edition, pp 46-49, 1961.

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CONCEPT # 8

Heat and Light

ACTIVITIES:

1. Measure heat with a thermometer. Is the body warmer than regular classroom air? Make other comparisons and contrasts.
2. By means of heat, demonstrate matter changes form (boil water, checking thermometer change as water heats) Refer to Concept #2.
3. Sources of heat, show by demonstration; the children may inquire and experiment with the "non-dangerous" activities)
   - a. Fire
   - b. Sunlight
   - c. Friction
   - d. Electricity
   - e. Gas, as in natural gas and gas for cars
4. Uses of heat energy
   - a. Cooking
   - b. Keeping warm
   - c. Drying wet objects
5. Making use of light (a by-product of many heat sources)
   - a. Value to plants to produce food
   - b. We see because of light - many illustrations are available
   - c. Light gives us colors; what colors?
     - (1) Rainbow
     - (2) Spray water into air (see a rainbow, which are the colors which make up light)
     - (3) Use a glass prism

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Neal, Safe and Simple Projects with Electricity

Pine, T., Light All Around, McGraw-Hill

Pine, T., Heat All Around, McGraw-Hill

Films

Heat and How We Use It, EBF, IMC #253

Light and What It Does, EBF, IMC #258

Tapes

Let's Find Out About Electricity, IPI, IMC #T 60

Textbooks

Bond, H., Looking at Science, pp 35-41, Lyon and Carnahan, 1963.

Craig, G., Science and You, Unit 16, Ginn and Company, 1965.

Navarra, J., Today's Basic Science, pp 130-135, Harper, 1967.

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Tannenbaum, H., Experiences in Science, Units 1 and 3, McGraw-Hill, Webster, 1966.

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Brandwein, P., Concepts in Science, pp 58-76, Harcourt, 1966.

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Level 2

Schneider, H., *Science for Here and Now*, pp 75-80, Heath, 1965.

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Level 3

Blough, G., *Science is Exploring*, Unit 2, Scott, Foresman and Company, 1965.

Bond, H., *Knowing about Science*, pp 112-119, 136-145, Lyon and Carnahan, 1963.

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Namowitz, Samuel, *Earth Science, The World We Live In*, D. Van Nostrand Company, Inc., Princeton, New Jersey, 1965.

* North Dakota Department of Public Instruction, *Elementary Science Handbook*, the department, pp 201-216, 1961.

CONCEPT # 9

Machines

ACTIVITIES:

1. How do we use machines in our work and play? (List the machines used that the children are familiar)
   a. Means of transportation
   b. Makes work easier
2. Bring in articles from paper and magazines concerning machines
3. After the collection is made from #2, group into types of machines.
   a. Simple
   b. Compound
4. Uses of machines, such as levers, etc.
5. Use a knife to peel a fruit to demonstrate the use of the wedge
6. Use heavy objects to have the children move, now move the same object by use of a machine (lever or roller)
7. Advantages of a wheel as a machine

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Pine, T., Simple Machines and How We Use Them, McGraw-Hill

Shapp, Martha and Charles, Let's Find Out About Wheels, Parents Magazine Press, Levels 1-2, $1.98.

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Films

Making Things Move, EBF, IMC #260

Making Work Easier, EBF, IMC #261

Tapes

Let's Find Out What Makes Things Move, IPI, IMC #T 51

Let's Find Out About Friction, IPI, IMC #T 54

Textbooks

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Level 2

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Textbooks Con't.

Level 3

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Fischler, A., Science, A Modern Approach, Unit 3, Holt, 1966.

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Schneider, H., Science Far and Near, pp 155-171, Heath, 1965.

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CONCEPT # 10

Sound

ACTIVITIES:

1. Sounds are all around us
    a. Listen for sounds of all types (loud, soft, pleasant, unpleasant, high, low, etc.) List a few.
2. How sounds are produced
    a. Produced by vibrations
        (1) Demonstrated by dropping a rock into a pan of water (sound vibrations travel in the same manner)
    b. Connect two cans with 10' of heavy string; permit children to talk into and receive sounds from the cans (primitive telephone)
    c. Obtain soda straw (large) flatten $\frac{1}{2}$" from the end. Trim slightly, place in mouth and blow. Place funnel over the end of the straw to produce unique sound.
    d. Tie a spoon in the center of a 5' piece of string. Wrap the string around your forefinger against an object, note the results.
3. Does sound travel through other forms of matter?
    a. Place ear to desk and scratch on desk top
    b. Place vibrating spoon in water, observe waves
4. Direct sound waves by use of megaphone

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Podendorf, I., Sounds We Hear, Childrens Press, Level K-4, 1955.

Films

Sound and How It Travels, EBF, IMC #421

Tapes

Let's Find Out What Sound Is, IPI, IMC #T 53

Textbooks

Craig, G., Science and You, Unit 9, Ginn and Company, 1965. 5

Navarra, J., Today's Basic Science, pp 137-145, Harper, 1967.

Level 2

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Level 3

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* Good teacher reference

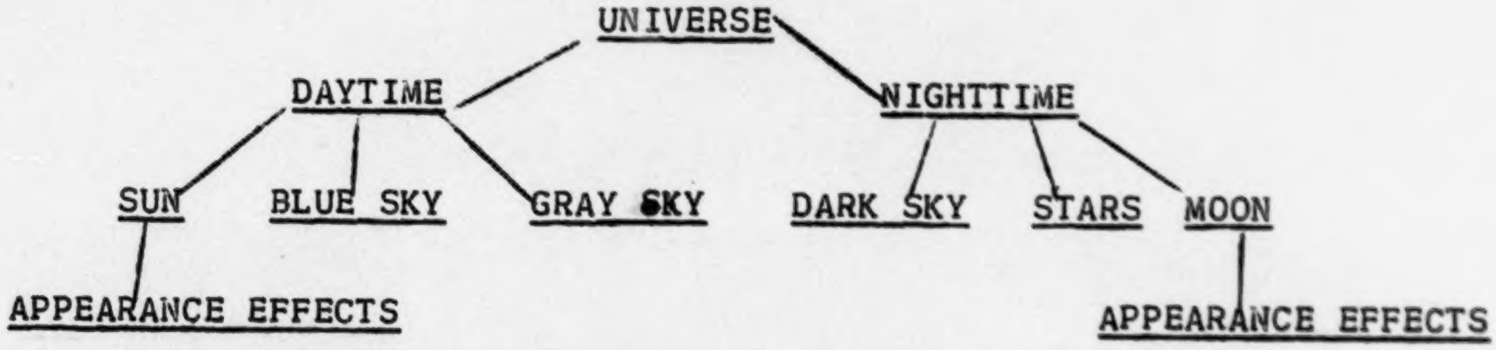
BEYOND THE EARTH UNIT

CONCEPT # 1

Universe

ACTIVITIES:

1. Observations of daytime sky and nighttime sky.


UNIVERSE
DAYTIME
NIGHTTIME
SUN
BLUE SKY
GRAY SKY
DARK SKY
STARS
MOON
APPEARANCE EFFECTS
APPEARANCE EFFECTS

2. Compare and contrast the size, shape, distance of planets

3. Compare size of sun and moon when coming up, compare to overhead

4. Note sky changes in day compared to night. What causes day and night?

    a. Take flashlight and focus on a ball, note one side is lighted (days) other side is dark (night)

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Hausman, L., The Big Book of Stars, Big Treasure Book, Gossett and Dunlap.

Lewellen, J., True Book of Moon, Sun and Stars, Childrens Press.

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Shapp, Martha and Charles, Let's Find Out About Sun, Parents Magazine, Press, Levels 1-2, $1.98.

Shapp, Martha and Charles, Let's Find Out About What's In The Sky, Parents Magazine Press, Levels 1-2, $1.98.

Tellander, Space, Follett Publishing Company, 1966.

Ziner, F., True Book of Time, Childrens Press.

Films

Exploring the Night Skies, EBF, IMC #249 (Levels 3, 4, 5)

Exploring the Universe, EBF, IMC #68 (Levels 3, 4, 5)

Gravity, How It Effects Us, EBF, IMC #252

How Do We Know The Earth's Shape, FA (Not at the IMC)

Filmstrips

Primary Science, EBF, IMC #86

Tapes

Let's Find Out About Our Earth in Space, IPI, IMC #T 49

Let's Find Out What's In The Sky, IPI, IMC #T 50

Let's Find Out About The Moon, IPI, IMC #T 56

Textbooks

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Navarra, J., Today's Basic Science, "Air" pp 22-41, "Our Earth and Sky" pp 42-65, Harper, 1967.

Schneider, H., Science for Work and Play, "Weather" pp 14-29 Heath, 1965.

Smith, H., Science 1, "The Universe" Unit 3, pp 72-95, Laidlaw, 1966.

Tannenbaum, H., Experiences in Science, "Weather" Unit 5, "Earth and Sun" Unit 4, McGraw-Hill, 1966.

Level 2

Bond, H., Thinking about Science, pp 82-96, Lyon and Carnahan, 1963.

Brandwein, P., Concepts in Science, Units 5 and 9, Harcourt, 1966.

Jacobson, W., Searching in Science, "Moon" pp 2-31, "Exploring Space" pp 162-189, American Book, 1965.

Navarra, J., Today's Basic Science, "Sun" pp 129-133, Harper, 1967.

Schneider, H., Science for Here and Now, "Weather" pp 131-143, Heath, 1965.

Smith, H., Science 2, "The Universe" Unit 3, pp 100-129, Laidlaw, 1966.

Tannenbaum, H., Experiences in Science, "Air" Unit 5, McGraw-Hill, Webster Division, 1966.

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Level 3

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Strong, C. L., The Amateur Scientist, The Scientific American Book of Projects, Simon and Schuster, New York, 1960.

CONCEPT # 2

Sun

ACTIVITIES:

1. Sun, most prominent star in daytime sky
2. Sun, our biggest star
3. Sun, center of our galaxie
4. Sun's surface is composed of hot, glowing gases
5. Note sun's apparent movement
    a. Does the sun really move? Earth's rotation? What causes the sun to appear to move?
6. Heating of earth's surface by sun
7. Does energy come from the sun? What about a falling object? Centrifical force?
8. Measure different lengths of shadows from the sun during the day
9. What makes night and day?
10. Why is moonlight called nighttime sun?

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Bendick, J., All Around You, McGraw-Hill.

Hausman, L., The Big Book of Stars, Big Treasure Book, Gossett and Dunlap.

Lewellen, J., True Book of Moon, Sun and Stars, Children's Press.

Pine, T., Light All Around, McGraw-Hill.

Podendorf, I., True Book of Space, Childrens Press.

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Shapp, Martha and Charles, Let's Find Out About Moon, Parents Magazine Press, Level 1-2, $1.98.

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Shapp, Martha and Charles, Let's Find Out About Sun, Parents Magazine Press, Level 1-2, $1.98.

Shapp, Martha and Charles, Let's Find Out About What's In The Sky, Parents Magazine, Levels 1-2, $1.98.

Tellander, Space, Follett Publishing Company, 1966.

Ziner, F., True Book of Time, Childrens Press.

Films

How We Study the Sun, FA (Not at the IMC)

Light and What It Does, EBF, IMC #252

Tapes

Let's Find Out About The Moon, IPI, IMC #T 56

Textbooks

Level 1

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Level 3

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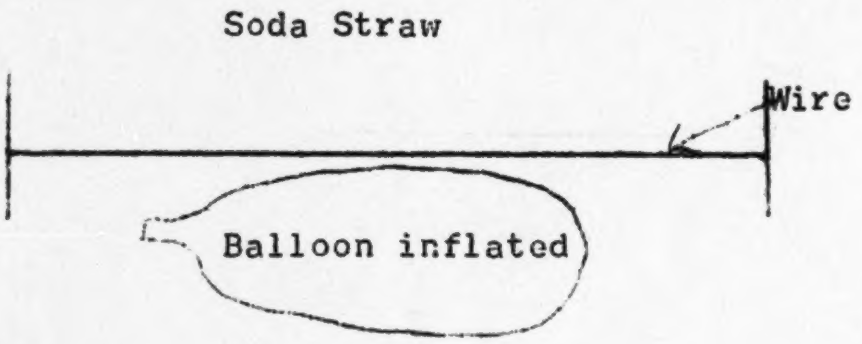
CONCEPT # 3

Stars in Space

ACTIVITIES:

1. Common nighttime constellations in the sky
2. Emphasize north star as a navigation point
3. Vastness of space
4. Space travel is accomplished by modern "ballooning" and rocketry
    a. Simulation of space travel, let balloon deflate, note movement. (See Elementary Science Handbook pp 251-264.



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Podendorf, I., True Book of Space, Childrens Press.

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Films

Exploring the Universe, EBF, IMC #68

Exploring the Night, EBF, IMC #249

Tapes

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Let's Find Out About the Moon, IPI, IMC #T 56

Textbooks

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Bond, H., *Looking at Science*, pp 15-16, 23, Lyon and Carnahan, 1963.

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Level 3 Con't.

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* Good teacher reference

CONCEPT # 4

Weather and Climate

ACTIVITIES:

1. Weather is the day to day changes in temperature, cloud condition, wind, etc. Why do we believe this is true?

2. What causes these changes?

   a. Unequal heating of the earth's surface.

3. Day to day changes causes our seasons

4. Seasons and yearly weather conditions gives us climate.

5. Show how man and other animals prepare for seasonal changes

6. Make a daily weather chart. Discuss it.

7. Check the newspapers and any other media (radio and television) to see how weather conditions change over the state or country. Make a weather chart for the area.

8. Make a wind vane (See North Dakota Science Handbook)

   a. For what are weather vanes used?

REFERENCES:

Children's Books

Hitte, K., Hurricanes, Tornadoes, and Blizzards, Random House

Podendorf, I., True Book of Weather Experiments, Childrens Press.

Podendorf, I., True Book of Seasons, Childrens Press.

Films

Wind and What It Does, EBF, IMC #426

Filmstrips

Primary Science, EBF, IMC #86

Tapes

Let's Find Out About Seasons, IPI, IMC #T 48

Let's Find Out About Weather, IPI, IMC #T 46

Textbooks

Level 1

Blough, G., Science is Fun, Unit 1, Scott, Foresman and Company, 1965.

Bond, H., Looking at Science, pp 46-53, Lyon and Carnahan, 1963.

Brandwein, P., Concepts in Science, Units 5, 6, Harcourt, 1966.

Craig, G., Science and You, Unit 2, Ginn, 1965.

Navarra, J., Today's Basic Science, pp 12-19, Harper, 1967.

Schneider, H., Science for Work and Play, pp 83-149, Heath, 1965.

Smith, H., Science 1, pp 55-56, Laidlaw, 1966.

Tannenbaum, H., Experiences in Science, Unit 5, McGraw-Hill, Webster Division, 1966.

Level 2

Brandwein, P., Concepts in Science, Unit 5, Harcourt, 1966.

Navarra, J., Today's Basic Science, pp 20-21, Harper, 1967.

Schneider, H., Science for Here and Now, pp 131-135, Heath, 1965.

Smith, H., Science 2, pp 49-57, Laidlaw, 1966.

Textbooks Con't.

Level 3

Jacobson, W., Learning in Science, "Weather" pp 34-61, "Climate" pp 89-93, American Book, 1965.

Schneider, H., Science Far and Near, pp 250-262, Heath, 1965.

Smith, H., Science 3, pp 74-110, Laidlaw, 1966.

Teacher's Reference

* Earth Science Curriculum Project, Investigating the Earth, ESCP, Houghton Mifflin Company, pp 178-203, 1960.

* Loebsack, Theo, Our Atmosphere, The New American Library of World Literature, Inc., 501 Madison Avenue, New York, Paperback edition, pp 73-130, 1961.

* Namowitz, Samuel, Earth Science, The World We Live In, D. Van Nostrand Company, Inc., Princeton, New Jersey, pp 449-530, 1965.

* North Dakota Department of Public Instruction, Elementary Science Handbook, the department, pp 429-450, 1961.

* North Dakota Department of Public Instruction, An Elementary Science Source Book, Volume II, the department, pp 1-29, 1963.

* Rapport and Wright, The Crust of the Earth, The New American Library of World Literature, Inc., 501 Madison Avenue, New York 22, New York, Paperback edition, pp 47-58, 1955.

Stone, George K., Science You Can Use, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1964.

Strong, C. L., The Amateur Scientist, The Scientific American Book of Projects, Simon and Schuster, New York, 1960.

CONCEPT # 5

Clouds and Rain

ACTIVITIES:

1. Show formation of clouds by;
   a. Boiling water in enclosed kettle
   b. Cloud jar - water and little smoke--in jar rubber on top, pull up and drop stretched rubber--cloud will form.
2. Warm air holds more water than cold. Why is this true?
   a. Illustrate by glasses - clouding up when entering warm room
   b. Cold glass - brought into a warm room; what happens?
3. Kinds of clouds:
   a. Names and appearance
   b. Look out of doors and observe the cloud formations

REFERENCES:

Children's Books

Blough, G., Not Only For Ducks, McGraw-Hill, Webster Division

Hitte, K., Hurricanes, Tornadoes, and Blizzards, Random House

Podendorf, I., True Book of Weather Experiments, Childrens Press

Filmstrips

Primary Science, EBF, IMC #86

Tapes

Let's Find Out About Weather, IPI, IMC #T 46

Textbooks

Level 1

Brandwein, P., Concepts in Science, pp 40-48, Harcourt, 1966.

Schneider, H., Science for Work and Play, pp 15-23, 66, Heath, 1965.

Smith, H., Science 1, pp 55-56, Laidlaw, 1966.

Level 2

Schneider, H., Science for Here and Now, pp 135-146, Heath, 1965.

Smith, H., Science 2, pp 92, Laidlaw, 1966.

Level 3

Jacobson, W., Learning in Science, pp 56-60, American Book, 1965.

Navarra, J., Today's Basic Science, pp 116-138, Harper, 1967.

Teacher's Reference

* Earth Science Curriculum Project, Investigating the Earth, ESCP, Houghton Mifflin Company, pp 178-203, 1967.

* Loebsack, Theo, Our Atmosphere, The New American Library of World Literature, Inc., 501 Madison Avenue, New York 22, New York, Paperback edition, pp 73-130, 1961.

* Namowitz, Samuel, Earth Science, The World We Live In, D. Van Nostrand Company, Inc., Princeton, New Jersey, pp 449-530, 1965.

* North Dakota Department of Public Instruction, Elementary Science Handbook, the department, pp 429-450, 1961.

* North Dakota Department of Public Instruction, An Elementary Science Source Book, Volume II, the department, 1963.

Stone, George K., Science You Can Use, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1964.

Strong, C. L., The Amateur Scientist, The Scientific American Book of Projects, Simon and Schuster, New York, 1960.

* Good teacher reference

CONCEPT # 6

Storms

ACTIVITIES:

1. Types of storms, classify
2. What causes storms?
    a. Rapid weather changes?
    b. When can we expect mild pleasant weather?
3. What means are used to warn people of coming storms?
4. Effects of storms
    a. List storms in their area and the damage they have done.
5. What precautions should one be familiar with in case of storms

THINGS TO DO:

1. Listen to the weather report of your local television and radio stations. What do these reports mean? tornado warnings? stockmen's warnings?
2. List the different types of damages created by storms.
3. Invite weather specialists from Federal Aviation Agency at Dickinson A rport (Contact Chief of Flight Service, Edward Marvin, telephone 225-2989, Dickinson, North Dakota)

REFERENCES:

Children's Books

Hitte, K., Hurricanes, Tornadoes, and Blizzards, Random House.

Films

Wind and What It Does, EBF, IMC #426

Filmstrips

Primary Science, EBF, IMC #86

Textbooks

Level 3

Jacobson, W., Learning in Science, pp 45-48, 180, American Book, 1965.

Teacher's Reference

* Earth Science Curriculum Project, Investigating the Earth, ESCP, Houghton Mifflin Company, pp 178-203, 1967.

* Loebsack, Theo, Our Atmosphere, The New American Library of World Literature, Inc., 501 Madison Avenue, New York 22, New York Paperback edition, pp 73-130, 1961.

* Namowitz, Samuel, Earth Science, The World We Live In, D. Van Nostrand Company, Inc., Princeton, New Jersey, pp 449-530, 1965.

* North Dakota Department of Public Instruction, Elementary Science Handbook, the department, pp 429-450, 1961.

* North Dakota Department of Public Instruction, An Elementary Science Source Book, Volume II, the department, pp 1-29 1963.

* Rapport and Wright, The Crust of the Earth, The New American Library of World Literature, Inc., 501 Madison Avenue, New York 22, New York, Paperback edition, pp 47-58, 1955.

Stone, George K., Science You Can Use, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1964.

Strong, C. L., The Amateur Scientist, The Scientific American Book of Projects, Simon and Schuster, New York, 1960.

* Good teacher reference

HEALTH UNIT

Introductory Statement

The health unit is not intended to be a complete course in health but only to relate that portion of health that traverses science studies. It is recommended that a complete course in health be offered in addition to the offerings included in this study.

CONCEPT # 1

How Living Things Grow

ACTIVITIES:

1. Review growth of an organism from seeds, eggs, etc.

2. Each seed or egg grows at a different rate. They are dependent upon oxygen, food, sunlight, temperature, water, etc. Let children try planting seeds with and without these ingredients--why don't they grow?

3. A student's growth is dependent upon proper amounts of these same things plus sleep, rest, play, work, etc. Why?

4. Energy, vigor and growth can be calculated by counting calories of a well-balanced diet (obtain a calorie counter)

5. Set up a guide for Basic Seven which foods nutritionists say are necessary for an essential diet.

    a. Leafy vegetables

    b. Citrus fruits

    c. Potatoes and other vegetables not in number one

    d. Milk products

    e. Meats

    f. Bread, cereals

    g. Butter

ACTIVITIES CON'T.

6. Basic Seven foods are needed to produce energy; to obtain the energy, oxygen is needed to burn the fuel. (As wood needs oxygen to burn)
7. Compare the children's meals for yesterday to the Basic Seven.

REFERENCES:

Children's Books

Blough, Glenn O., Wait for the Sunshine, Levels 1-3, McGraw-Hill.

Blough, Glenn, Who Lives in This House, Levels 1-3, McGraw-Hill.

Byrd, Oliver, Health 1, Laidlaw Brothers, River Forest, Illinois.

Byrd, Oliver, Health 2, Laidlaw Brothers, River Forest, Illinois.

Carona, Philip, True Book of Chemistry, Childrens Press, 1965.

Follett, Robert, Your Wonderful Body, Follett Publishing, 1961.

Frahm, Anne, True Book of Bacteria, Childrens Press, 1963.

Films

Living and Growing, Churchill, IMC #791

Your Body and Its Parts, EBF, IMC #86

Your Food, EBF, IMC #87

Your Sleep and Rest, EBF, IMC #88

Your Teeth, EBF, IMC #89

Your Eyes, EBF, IMC #90

Your Ears, EBF, IMC #91

Your Protection Against Diseases, EBF, IMC #92

Filmstrips

Learning about Ourselves, EBF, to be released

Good Health and You, Eyegate, IMC #314

Tapes

Water--The Giver of Life, IPI, IMC #T 67

Textbooks

Level 1

Brandwein, P., Concepts in Science, pp 118-126, Harcourt, 1966.

Craig, G., Science and You, Unit 4, Ginn, 1965.

Schneider, H., Science for Work and Play, pp 76-101, 133-137, Heath, 1967.

Smith, H., Science 1, pp 126-139, Laidlaw, 1966.

Level 2

Brandwein, P., Concepts in Science, pp 120-124, Harcourt, 1966.

Jacobson, W., Searching in Science, pp 130-157, American Book, 1965.

Navarra, J., Today's Basic Science, pp 103-117, Harper, 1967.

Schneider, H., Science for Here and Now, pp 195-209, Heath, 1965.

Smith, H., Science 2, pp 178-187, Laidlaw, 1966.

Level 3

Jacobson, W., Learning in Science, pp 146-149, 186-187, American Book, 1965.

Navarra, J., Today's Basic Science, pp 157-191, Harper, 1967.

Schneider, H., Science Far and Near, pp 1-17, Heath, 1965.

Smith, H., Science 3, pp 194-223, Laidlaw, 1966.

Teacher's Reference

Blough, Glenn and others, Elementary School Science and How To Teach It, Holt, Rinehart, and Winston, New York, 1964.

de Kruif, Paul, Microbe Hunters, Pocket Books, Inc., New York, Paperback edition, 1953.

Teacher's Reference

Moon, Truman and others, Modern Biology, Henry Holt and Company, New York, pp 471-665, 1960.

Morholt, Brandwein, Joseph, A Sourcebook for the Biological Sciences, Harcourt, Brace and Company, New York, 1958.

Nicolle, Jacques, Louis Pasteur, The Story of His Major Discoveries, Fawcett Publications, Inc., Greenwich, Connecticut, 1961.

North Dakota Department of Public Instruction, Elementary Science Handbook, the department, 1961.

North Dakota Department of Public Instruction, An Elementary Science Source Book, Volume I, the department, 1963.

North Dakota Department of Public Instruction, An Elementary Science Source Book, Volume II, the department, 1963.

* Stone, George K., Science You Can Use, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, pp 41-76, 1964.

* Visual Products 3M School Health Education Study, 3M Corporation, Visual Products, Inc., Bismarck, North Dakota.

* Good teacher reference

CONCEPT # 2

All Living Things are a Product of Their Heredity and Environment

ACTIVITIES:

1. Take a field trip--see how things differ, good soil, lack of water, lack of sunlight, etc. Environment determines growth, even life.
2. Heredity--inside the nucleus of cell controls growth but can be modified by environment. A child may influence growth of a plant by changing the environment, heat, cold, dryness, too much water, etc.
3. Modify your environment by good living, brush teeth, eat good foods, get lots of sleep and exercise, need for fresh air, keeping clean, etc.
4. "Like begets like"
5. Blow cigarette smoke into a white tissue, observe. (Have someone not part of the class provide the demonstration)

REFERENCES:

Children's Books

Blough, Glenn, Soon After September, Levels 1-3, McGraw-Hill.

Clark, Mary Lou, You and Relativity, Childrens Press, 1965.

Lewellen, John, You and Your Amazing Mind, Childrens Press, 1965.

Neal, Charles, Sound, Follett, 1962.

Schatz, Letta, When Will My Birthday Be?, Levels 1-3, McGraw-Hill.

Schwartz, Julius, Now I Know, Levels 1-3, McGraw-Hill.

Uhl, Melvin, About Eggs and Creatures that Hatch From Them, Childrens Press, Melmont Division, 1966.

Films

What Plants Need for Growth, EBF, IMC #236

Tapes - (intermediate level--teacher may have to edit material)

Health As You Grow, (Elementary TAMA)

Overeating and Undereating, TAMA

Physical Fitness, TAMA

Keeping Clean Means Keeping Healthy, TAMA

How My Body Works, TAMA

Textbooks

Level 1

Brandwein, P., Concepts in Science, pp 118-126, Harcourt, 1966.

Craig, G., Science and You, Unit 3, Ginn, 1965.

Level 2

Brandwein, P., Concepts in Science, pp 120-124, Harcourt, 1966.

Jacobson, W., Searching in Science, pp 44-51, American Book, 1965.

Smith, H., Science 2, pp 166-176, Laidlaw, 1966.

Teacher's References

Blough, Glenn and others, Elementary School Science and How To Teach It, Holt, Rinehart and Winston, New York, 1964.

de Kruif, Paul, Microbe Hunters, Pocket Books, Inc., New York, Paperback edition, 1953.

Fitzpatrick, Bain and Teter, Living Things, Holt, Rinehart, and Winston, Inc., New York, 1962.

Johnson, Gaylord, Hunting with the Microscope, Sentinel Books, 112 East 19th Street, New York 3, New York, 1956.

* Moon, Truman and others, Modern Biology, Henry Holt and Company, New York, pp 56-77, 1960.

Morholt, Brandwein, Joseph, A Sourcebook for the Biological Sciences, Harcourt, Brace and Company, New York pp 191-209, 246-266, 1958.

Teacher's Reference

Namowitz, Samuel N., Earth Science, The World We Live In, D. Van Nostrand Company, Inc., Princeton, New Jersey, 1965.

Nicolle, Jacques, Louis Pasteur, The Story of His Major Discoveries, Fawcett Publications, Inc., Greenwich, Connecticut, 1961.

* North Dakota Department of Public Instruction, Elementary Science Handbook, the department, pp 363-397, 1961.

* North Dakota Department of Public Instruction, Health Education, Area of Smoking,the department, 1967.

* Good teacher reference

REFERENCES

ADDRESSES OF PUBLISHERS

Many books in science and science education offer splendid opportunities for additional study and investigation by children or for enrichment of teaching background. Most of these books are of sufficient conceptual depth and richness of content to provide broad avenues for exploration by the most exacting teacher of this grade or by the most inquisitive, imaginative, or creative child. The names and addresses of all the publishers whose titles are suggested are given below.

Abelard-Schuman	Abelard-Schuman, Ltd., 6 W 57th St. New York, New York, 10019.
Abington Press	Abington Press, 201 Eighth Ave. South, Nashville, Tenn. 37203
Basic Books	Basic Books, Inc., 59 Fourth Ave. New York, New York, 10003.
Benefic Press	Benefic Press, 1900 N. Narragansett, Chicago, Illinois 60639.
Childrens Press	Childrens Press, Inc., Jackson Blvd. and Racine Ave. Chicago.
Coward-McCann	Coward-McCann, Inc., 200 Madison Ave. New York, 10016.
Crowell	Thomas Y. Crowell Co., 201 Park Ave. South, New York, 10003.
Devin-Adair	The Devin-Adair Co., 23 E 26th St. New York, New York 10010.
Dodd, Mead	Dodd, Mead and Co., 432 Park Ave. So. New York, New York 10016.
Doubleday	Doubleday and Co., Inc., 277 Park Ave. New York, New York, 10017.
Follett	Follett Pub. Co., 1010 W. Washington Blvd, Chicago, Ill. 60607.
Franklin Watts	Franklin Watts, Inc., 575 Lexington Ave. New York, New York 10022.
Garrard	Garrard Pub. Co., 1607 No. Market St. Champaign, Ill 61821.
Golden Press	Golden Press, Inc., 950 Third Ave., New York, New York 10022.
Gossett and Dunlap	Gossett and Dunlap, 51 Madison Ave. New York, New York 10010.
Harcourt, Brace & World	Harcourt, Brace & World, Inc., 757 Third Ave. New York 10017.
Harper & Row	Harper & Row Pub., 49 E. 33rd St. New York, New York 10016.

Holiday House	Holiday House, 8 West 13th St. New York, New York 10011.
Holt	Holt, Rinehart and Winston, Inc., 383 Madison Ave. New York 10017.
Houghton Mifflin	Houghton Mifflin Co. 2 Park St. Boston, Mass. 02107.
John Day	The John Day Co., Inc., 200 Madison Ave. New York 10016.
Knopf	Alfred A. Knopf, Inc., 501 Madison Ave. New York 10022.
Lothrop, Lee & Shepard	Lothrop, Lee & Shepard, Inc., 419 Park Ave. South, New York 10016.
Macmillan	The Macmillan Co., 60 Fifth Ave., New York 10011.
McGraw-Hill	McGraw-Hill, Webster Division, Manchester Rd. Manchester, Mo. 63011.
Messner	Julian Messner, Inc., 8 W 40th St. New York, New York 10018.
Morrow	William Morrow & Co., Inc., 425 Park Ave. So. New York 10016.
National Science Ass'n	Science Teacher Ass'n, "Science Teacher" NEA, 1201 16th St. NW, Washington, D.C. 20036.
National Science Ass'n	Science Teacher Ass;n, "Science and Children" NEA 1201 16th St. NW, Washington, D.C. 20036.
North Dakota Department	North Dakota Department of Public Instruction, State Capitol Bldg. Bismarck, North Dakota.
North Dakota State Water	North Dakota State Water Conservation Committee, State Capitol Bldg. Bismarck, North Dakota.
Parents Magazine Press	Parents Magazine Press, 52 Vanderbilt Ave. New York, New York 10017.
Prentice-Hall	Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 07631.
Random House	Random House, Inc., 457 Madison Ave. New York, New York 10022.
William R. Scott	William R. Scott, Inc., 8 W 13th St. New York, New York 10011.
Univ. of Chicago	University of Chicago Press, 575 Ellis Ave. Chicago, Ill 60637.
Viking	The Viking Press, 625 Madison Ave. New York, New York 10022.
Whitman	Albert Whitman & Co. 560 W Lake Street, Chicago, Ill 60606.
Whitman	Whitman Publishing Company, Racine, Wisconsin.

ADDRESSES OF AUDIO-VISUAL SUPPLIERS

The teaching suggestions for each unit of this guideline lists a number of film and filmstrips for classroom showing. Orders or further requests for information should be addressed to the following distributors or suppliers whose names are given in abbreviated form at the left.

EBF	Encyclopaedia Britannica Films, Inc., 1150 Wilmette Ave. Wilmette, Ill. 60091.
FA	Film Associates of California, 10521 Santa Monica Blvd., Los Angeles, California 90025.
IMC	Instructional Media Center, 444 West Fourth Street, Dickinson, North Dakota 58601.
McGraw	McGraw-Hill, Text Film Department, 330 West 42nd Street, New York 10036.
IPI	Imperial Productions Inc., KanKaKee, Illinois 60901 (Colburns)
TAMA	TAMA,608 Second Avenue South, Minneapolis, Minnesota 55402.

OTHER BOOKS FOR READING AND REFERENCE

Adventures in Electrochemistry, Alfred Morgan, Scribner.
After-dinner Science, K. M. Swezey, McGraw.
All about Eggs, Millicent Selsam, William R. Scott.
All about Electricity, Ira M. Freeman, Random.
All about the Atom, Ira M. Freeman, Random.
Amateur Naturalist's Handbook, Vison Brown, Little.
Animal Homes, G. F. Mason, Morrow.
Animals without Backbones, Ralph Buchsbaum, U of Chicago.
Antarctic World, John Euller, Abelard.
Atomic Energy, Irene Jaworski and Alex Joseph, Harcourt.
Atompower, Joseph M. Dukert, Coward.
Aviation from the Ground Up. John Floherty, Lippincott.
Birds in Your Back Yard, T. S. Pettit, Harper.
The Clock We Live On, Isaac Asimov, Abelard.
Clouds, Air, and Wind, Eric Sloane, Devin.
Deep in Caves and Caverns, Lynn and Gray Poole, Dodd.
Discovering Chemistry, Elizabeth Cooper, Harcourt.
Electronics, R. Irving, Knopf.
Electronics for the Beginner, Jay Stanley, Bobbs.
Electronics for Young People, Jeanne Bendick, McGraw.
Everyday Machines and How They Work, Herman Schneider, McGraw.
Experiments in Chemistry, Beeler & Branley, Crowell.
Experiments in Magnetism and Electricity, Harry Sootin, Watts.
Experiments in Optical Illusion, Beeler & Branley, Crowell.
Experiments in Science, Beeler & Branley, Crowell.
Experiments in Sound, Nelson F. Beeler, Crowell.
Experiments in the Principles of Space Travel, Branley, Crowell.
Experiments with Atomics, Beeler and Branley, Crowell.
Exploration of Space, Robert Jastrow, Macmillan.
Exploring for Fun, A Young Explorer's Handbook, W. Burns, Dutton.
Exploring Under the Earth, Roy A. Gallant, Doubleday.
Fabulous Isotopes, Robin McKown, Holiday.
First Book of Light, George Russell Harrison, Watts.
First the Flower and Then the Fruit, J. M. Lucas, Lippincott.
Flowing Gold, John Floherty, Lippincott.
From Head to Fott, A. Novikoff, International.
Fun with Cooking, M. G. Freeman, Random House.
Fun with Science, M. G. Freeman and I. M. Freeman, Random House.
Geology, Richard M. Pearl, Barnes and Noble.
Going into Space, Arthur C. Clarke, Harper.
Golden Book of Astronomy, R. Wyler and G. Ames, Golden.
Golden Book of Science, B. M. Parker, Golden
Golden Nature Guides, H. S. Zim and others, Simon and Schuster.
Golden Picture Book of Science, Rose Wyler, Golden.
Helicopters: How They Work, J. B. Lewellen, Crowell.
How and Why Book of Rocks and Minerals, Nelson Hyler, Grosset.
How Man Discovered His Body, S. R. Riedman, International.
How To Know the Birds, Roger T. Peterson, Houghton.
How To Know the Minerals and Rocks, Richard M. Pearl, McGraw.
How Your Body Works, Herman and Nina Schneider, Scott.
101 Science Projects, George K. Stone, Prentice-Hall.
Interplanetary Flight, Arthur C. Clarke, Harper.
Introduction to Atomic Energy, William G. Atkinson, Rider.

Introduction to Birds, John Kieran, Doubleday.
Introduction to Electronics, Highes and Pipe, Doubleday.
Invitation to Experiment, Ira M. Freeman, Dutton.
It's Fun to Know Why, Julius Schwartz, McGraw.
Kitchen Table Fun, A. Nagle and J. Leeming, Lippincott.
Making Electricity Work, John M. Kennedy, Crowell.
Mineral Collector's Guide, Ward's Natural Science Establishment.
Mr. Wizard's Experiments, Don Herbert, Doubleday.
The Moon, Earth's Natural Satellite, Branley, Crowell.
More Experiments in Science, Beeler & Branley, Crowell.
More Power to You, Herman and Nina Schneider, Scott.
More Research Ideas for Young Scientists, G. Barr, McGraw.
My Hobby is Photography, Don Langer, Childrens.
Nature Notebook, Robert Candy, Houghton.
Our Amazing Earth, C. L. Fenton, Doubleday.
Photography, Godfrey Frankel, Sterling.
Picture Book of Astronomy, J. S. Meyer, Lothrop.
Picture Book of Chemistry, J. S. Meyer, Lothrop.
Plants in the City, Herman and Nina Schneider, Day.
Plants That Feed Us. Carolle Fenton, Day.
Pocket Nature Guides, Doubleday.
Prisms and Lenses, J. S. Meyer, World.
Putnam's Nature Field Books, Putnam.
Rainbow Book of Nature, Donald Culross Peattie, World.
Reproduction and Sex in Animal Life, Charles Gramet, Abelard,
Rock Book, C. L. Fenton and M. A. Fenton, Doubleday.
Rockets and Jets, Marie Neurath, Lothrop.
Rockets and Your Future, S. Beitler, Harper.
Rockets to the Planets. E. Bergaust, Putnam.
Science Experiences with Home Equipment, Lynde, Van Nostrand.
Science Magic, K. M. Swizey, McGraw.
Science of Ourselves, McBain and Johnson, Harper.
Science on the Shores and Banks, Eliz. Cooper, Harcourt.
Science Puzzlers, M. Gardner, Viking.
Secret of Light, Irving Adler, Internatinnal.
Space for Everyone, P. S. Egan, Rand.
Stars, H. A. Rey, Houghton.
Stars by Clock and Fist, Henry Neely, Viking.
Story of Planets, Space and Stars, G. Johnson, Harvey.
Study of Plant Communities, Henry Oosting, Freeman.
Sun, Earth and Man, George and Eunice Bischoff, Harcourt.
Sun, Moon and Stars, Skilling and Richardson, McGraw.
1001 Questions Answered About the Mineral Kingdom, Pearl, Grossett.
1001 Questions Answered About the Sea Shore, Berrill, Grossett.
Treasures of the Earth, Fred Reinfeld. Sterling.
The Universe, Bergamini and editors of Life, Time Inc.
Wonder of Light, Hy Ruchlis, Harper.
Wonderful Egg, G. W. Schloat, Jr. Schribner.
Wonders of the Bird World, Helen Cruikshank, Dodd.
Wonders of the Human Body, Anthony Ravielli, Viking.
Wonders of Seeds, Shirley Briggs, Crowell.
World Aloft, Guy Murchie, Houghton.